भारतीय मानक
Indian Standard

IS 5521 : 2022

मोलासेस के भंडारण के लिए स्टील टैंक — विशिष्टि

(दूसरा पुनरीक्षण)

Steel Tanks for Storage of Molasses — Specification

(Second Revision)

ICS 65.040.20

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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April 2022 **Price Group 4**

Sugar Industry Sectional Committee, FAD 02

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Sugar Industry Sectional Committee had been approved by the Food and Agriculture Division Council.

Molasses, which is often referred to a waste product of sugar factories, is an important raw material for distilleries producing alcohol. Storage of molasses without deterioration is important. Presently, molasses is being stored in many places in kachha or pucca masonry tanks with or without roofs where molasses is likely to get diluted with and have losses due to seepage and contamination leading to its deterioration Construction of molasses tanks, preferably of steel, is of marked importance in arresting the deterioration and wastage of molasses. This standard gives the specification of steel tanks for efficient storage of molasses.

This standard is intended chiefly to cover the technical provisions relating to the construction of covered mild steel tanks for storage of molasses.

This standard was published in 1969. Subsequently, this standard was revised 1980, the format has been changed and the requirements of uniformity and recommendatory nature have been appended to the essential requirements to enable better implementation of the standard. In this revision, requirements of higher capacity included, the provision of Peripheral vertical columns has been deleted and number of accessories added to molasses tank. Water spraying coil requirement added in this revision.

The recommendations on location of the steel tanks in case of sugar factories and construction of a cement concrete or masonry platform are given in Annex A for guidance.

The composition of the Committee responsible for the formulation of this standard is given at Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numeral values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in the relevant referred standard.

Indian Standard

STEEL TANKS FOR STORAGE OF MOLASSES — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers the requirements of materials, recommended volumes and dimensions, method of construction, and testing of mild steel tanks for storage of molasses in sugar factories.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards given below:

IS No.	*Title*
800 : 2007	General construction in steel — Code of practice (*third revision*)
803 : 1976	Code of practice for design fabrication and erection of vertical mild steel cylindrical welded oil storage tanks (*first revision*)
816 : 1969	Code of practice for use of metal arc welding for general construction in mild steel (*first revision*)
875 (Part 3) : 2015	Design loads (other than earthquake) for buildings and structures — Code of practice: Part 3 Wind loads (*third revision*)
1162 : 2021	Cane Molasses — Specification (*first revision*)
1730 : 1989	Dimensions for steel plates, sheets strips and flats for general engineering purposes (*second revision*)
1893 (Part 2) : 2014	Criteria for earthquake resistant design of structures: Part 2 Liquid retaining tanks (*fifth revision*)
2062 : 2011	Hot rolled medium and high tensile structural steel — Specification (*seventh revision*)

3 TERMINOLOGY

For the purpose of this standard, the following definition shall apply.

3.1 Cane Molasses — The mother liquor left over after the recovery of sugar in the vacuum pan process (*see* IS 1162).

4 VOLUMES AND DIMENSIONS

The diameter and height of the molasses storage tanks usually depends upon the size of the ground area available and the volume of molasses required to be stored. Table 1 gives the recommended volumes and dimensions of tanks for storage of molasses.

NOTES

1 The height of the tank shall be determined taking into consideration the soil bearing capacity and the cost of making foundation suitable for the recommended height.

2 The volume of tanks for storing molasses for a sugar factory of cane crushing capacity 1 250 tonnes per day may be calculated as given in **A-3**.

5 MATERIALS

5.1 The tank for storage of molasses shall be built from mild steel plates with Grade A (*see* IS 2062).

5.2 Thickness of the steel plates used in the bottom, shell and roof shall be as given in Table 1 (*see* IS 1730).

5.3 Fabrication procedure shall be as per IS 803.

5.4 Tank shall be designed with due consideration of seismic loading as per 1893 (Part 2).

5.5 The welding details of shell should be as per the Fig. 6 of IS 803.

5.6 The welding of top curb angle with shell and roof should be as per Fig. 7 of IS 803.

Table 1 Recommended Volumes and Dimensions for Steel Tanks for Storage of Molasses

(*Clause* 4)

Volume	Effective volume	Height	Diameter	Bottom plate	1st Course	2nd Course	3rd Course	4th Course	5th Course	6th Course	Last 2 Course	Roof
(m^3)	(m^3)	(m)	(m)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1250	1125	8	14.11	12	8	6	4	6	6	6	6	5
1500	1350	8.5	14.99	12	8	8	6	6	6	6	6	5
2000	1800	9.6	16.29	12	10	8	6	6	6	6	6	5
2500	2250	9.8	18.03	12	12	10	8	6	6	6	6	5
3000	2700	9.6	19.95	12	12	10	8	6	6	6	6	5
3500	3150	9.8	21.33	12	14	12	10	8	6	6	6	5
4000	3600	9.6	23.04	12	14	12	10	8	6	6	6	5
4500	4050	9.8	24.19	12	16	12	10	8	6	6	6	5
5000	4500	9.6	25.76	12	16	14	12	10	8	6	6	5
5500	4950	9.6	27.02	12	16	14	12	10	8	6	6	5
6000	5400	9.8	27.93	12	18	14	12	10	8	6	6	5
6500	5850	10	28.78	12	18	16	14	12	10	8	6	5
7000	6300	10	29.86	12	20	16	14	12	10	8	6	5
7500	6750	10	30.91	12	20	16	14	12	10	8	6	5
8000	7200	10	31.92	12	20	16	14	12	10	8	6	5

6 FABRICATION

6.1 All joints shall be seam or butt welded. The welded joints shall be sound and finished smooth inside and shall be water-tight. The bottom plates shall be V-grooved and welded with butt welding. Mild steel strip 60 mm wide and 6 mm thick shall be provided (over lapped welded) over the welds. After welding of bottom plate, Weldment should be checked with Die pentrant/magnetic particle inspection method.

6.2 The permissible stresses for welds and welded connections shall conform to values given in IS 816.

6.3 Suitable radial trusses shall also be employed for support of the roof of the tank (*see* Fig. 1), which may directly be supported on the shell plates with a curb angle at the roof level all around.

6.4 Centre Column

Two channels MC 300 or MC 225 at right angles to each other with suitable saddle at the base shall be provided (*see* IS 803).

6.5 The permissible stresses for the bottom, shell and roof of the tank shall be in accordance with IS 800.

6.6 The tank shall be designed with due consideration to the wind loads, which shall be in accordance with IS 875 (Part 3).

6.7 To ensure proper welding of bottom plate with the first shell course, minimum outside projection of bottom plate from shell should be 25 mm.

6.8 Minimum spacing or unsupported length of the roof plate should not be more than 2 100 mm.

7 FITTINGS AND ACCESSORIES

7.1 The tank shall be fitted with the following accessories and fittings and shall be provided with suitable openings for fittings as described in **7.1.1** to **7.1.14** and shown in Fig. 1.

7.1.1 *Outlet*

The outlet shall be of steel with a minimum diameter of 15 cm and shall be located on the first course of the tank 15 cm above the bottom. The suction for pumping molasses should be from the side of the tank.

7.1.2 *Outlet Discharge Valve*

A sluice valve, of stainless steel, Class 150, followed by another similar valve, in series shall be fitted to the outlet opening.

7.1.3 *Drainage or Washout Valve*

A stainless steel sluice valve, Class 150, followed by another similar valve, in series shall be fitted at the bottom of the tank and also connected to the outlet (*see* **6.1.1** and Fig. 1).

7.1.4 *Inlet*

The inlet of molasses shall preferably be at the bottom (*see* Fig. 1) unless the molasses is discharged through an overhead pipeline in which case the molasses should not be allowed to fall from a height as in doing

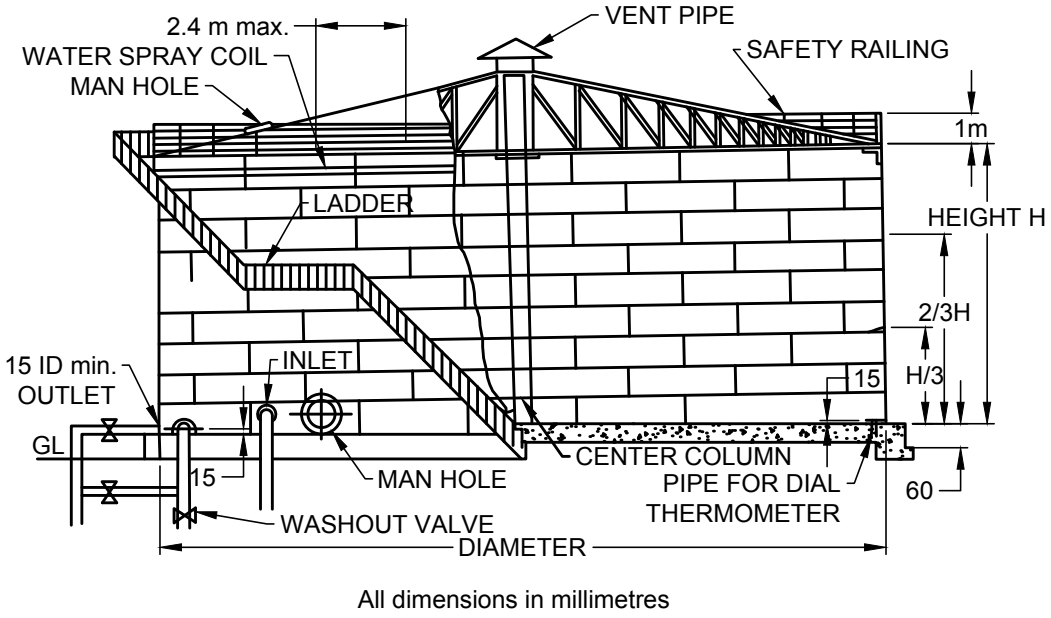


FIG. 1 DETAILS OF THE STEEL TANK FOR STORAGE OF MOLASSES

so a lot of air gets occluded, which is not desirable. Instead, the pipe may be held tangential to the inside of the wall about a meter from the top. The inlet shall be fitted with a non-return valve followed by a sluice valve.

7.1.5 *Indicator Thermometer*

The tank shall be provided with at least three RTDs or 15 cm dial thermometers, one about 0.15 m from the bottom, other at one-third height and the third at two-thirds height of the tank.

7.1.6 *Manhole*

Two manholes having diameter of 45 to 60 cm shall be located one on the top and other on the side bottom of the tank (*see* Fig. 1). A suitable attachment shall be provided to securely hold the man-way door in position through a suitable bracket. A bolt without attachment shall be fitted to hold the bracket in position, alternatively, a loose cover with lifting handle may be provided. The manhole covers shall be water-tight.

7.1.7 *Safety Railing*

A safety railing, with toe plate, all around the roof of the tank shall be provided. The railing shall be of the height of 1 m. The maximum distance between two railing posts shall be 2.4 m (*see* Fig. 1).

A walkway on the top of the roof sheet is to be marked with weather proof paint near the trusses for safety purpose.

7.1.8 *Vent Pipe or Chimney*

A vent pipe or chimney shall be provided at the center of the roof for venting out of the gas (*see* Fig. 1). For large size tank over 16 m diameter, more than one vent pipe may be provided. The mouth of the vent pipe shall be suitably protected with wire netting.

7.1.9 A 25 mm drip cock shall be provided at the outlet for sampling purposes.

7.1.10 *Water Spraying Coil*

Provision of a perforated water spraying coil 25/40 mm in diameter shall be made all round outside the tank with water inlet connections at Four peripheral Points. The direction of the perforations shall be such that the water flows along the sides of the tank (*see* Fig. 1).

7.1.11 *Painting*

The tank shall be suitably painted on the outside and with anti-corrosive paint on the inside. The roof, and the supporting trusses and the top strake may be painted inside also.

7.1.12 *Staircase*

The tank shall be provided with a staircase of sturdy construction and design and made of mild steel, duly painted. The staircase shall be provided with suitable hand railing and adequate landings.

7.1.13 The tank may be provided with a suitable level indicator.

7.1.14 All openings in the tank shall be so made that there is no possibility of accumulation of liquid or other foreign matter and the entrances are protected against dust, insects, and other extraneous materials. All component parts shall be capable of being cleaned and inspected in position or by dismantling, if necessary.

7.1.15 To include following accessories as a part of molasses tank:

a) Suitably designed molasses cooling system; and
b) Re-circulation pumping system.

7.1.16 Reinforcement pad of diameter twice, the nozzle pipe OD is recommended.

7.1.17 Circumferential spacing between two successive foundation bolts shall not exceed 3 m. Minimum size of foundation bolts should be M 30.

8 TANK TESTING

8.1 The tank shall not leak when tested by the following method.

8.1.1 *Bottom Testing*

8.1.1.1 After the bottom and at least the bottom courses of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case of not less than 100 mm H_2O gauge. The pressure shall be held by the construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for the detection of leaks.

8.1.1.2 Subject to the agreement of the purchaser, molasses may be used instead of air and soap suds to test for leaks.

8.1.1.3 Alternatively, the bottom seams may be tested by the vacuum-box method.

8.1.2 *Shell Testing*

8.1.2.1 The shells of tanks shall be tested after the completion of the roof. Wherever possible, testing shall be by filling the tank with water to the level of the top course.

8.1.2.2 Where local conditions are such that testing with water is impractical, the tank shall be testing by painting or spraying all joints on the inside with a highly penetrating oil and noting any leaks.

8.1.3 *Repair of Leaks*

8.1.3.1 All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion, the entire tank shall be tight and free from leaks.

8.1.3.2 In the joints between roof plates only, pinhole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity the leaks shall be sealed. by laying down an additional layer of weld metal over the porous section.

8.1.3.3 In all other joints, whether between shell plates or bottom plates or both, leaks shall be repaired only by welding, if necessary, after first cutting out the defective part.

8.1.3.4 When the tank is filled with water for testing, defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

8.1.3.5 No welding shall be done on any tank unless all lines connecting there to have been completely blanked off. No repairs shall be attempted on tanks while filled with molasses, nor any tanks which have contained molasses until the tank has been emptied, cleaned and gas freed in a safe manner. No repairs shall be attempted by erector on a tank which has contained molasses except in a manner approved in writing by the purchaser, and in the presence of the purchaser's inspector.

9 MARKING

9.1 The tank shall be marked legibly and permanently with the following particulars:

a) Tank number, and
b) Volume of the tank in m^3.

9.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed there under, and the products may be marked with the Standard Mark.

ANNEX A

(*Clause* **4.1**)

DETAILS OF LOCATION, CONSTRUCTION OF PLATFORM AND CALCULATION OF VOLUME OF STEEL TANKS FOR STORAGE OF MOLASSES

A-1 LOCATION

A-1.1 The tank shall be adjacent to the factory to facilitate easy transport of molasses to the tank. The tank, as far as possible, should be away from sugar godowns, spray ponds and effluent drains.

A-1.2 The general location of the tank is indicated in Fig. 2.

A-2 CONSTRUCTION OF PLATFORM OF PLINTH

It is necessary that tanks are built on good foundations. Details of a typical foundation normally adopted are shown in Fig. 3, where soil conditions are adverse, care should be taken to design the foundation properly such that no subsidence takes place.

A-3 CALCULATION OF VOLUMES OF TANKS

The volume of the tanks for storing molasses for a factory of 1 250 tonnes per day cane crushing capacity may be calculated as follows. The required volume for different factories with varying cane crushing capacities may be calculated accordingly:

a)	Average molasses production, percent cane	4.0
b)	Average duration of season in days	140
c)	Total molasses production in tonnes for the season	7000
d)	Volume of molasses in litres/tonne at 90 Brix	708
e)	Volume of molasses in m^3 produced in the season	4955
f)	Add 10 percent for foam, in m^3	496
g)	Total gross volume in m^3 available for storage	5451 or 5500
h)	Recommended number of tanks	2 (*see* Note 2 under **4**)

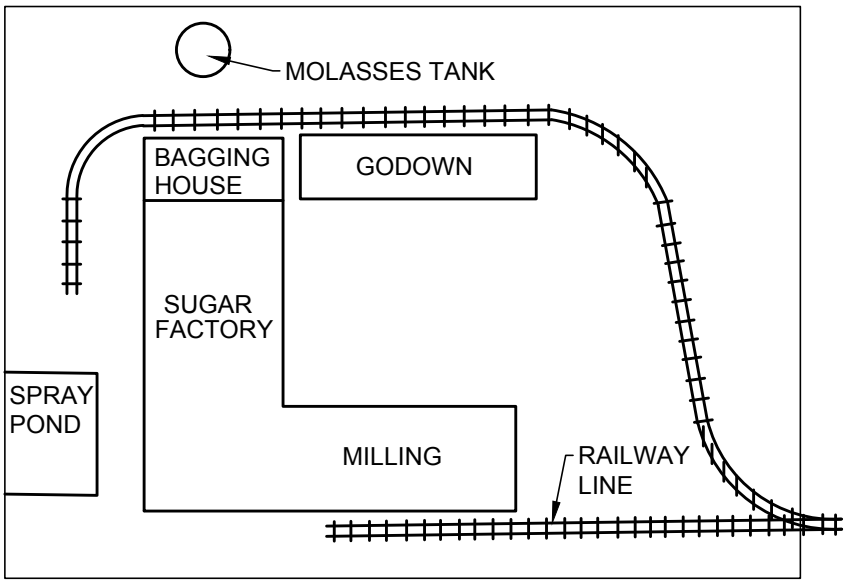
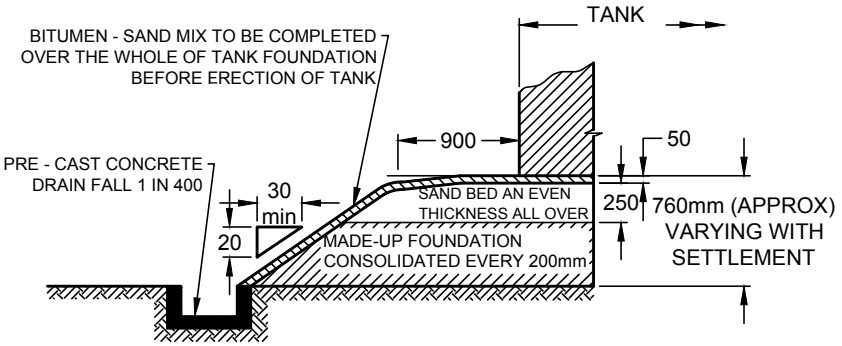


FIG. 2 GENERAL LOCATION OF A STEEL TANK FOR STORAGE OF MOLASSES

Bitumen-Sand or Road-Tar Mix — In preparing this bitumen-sand mix it is necessary for the engineer-in-charge to make sure that the mix used gives the desired result, that is, a layer which is as waterproof as possible but at the same time sufficiently firm to carry the necessary traffic and to permit the welding of the bottom plates. To obtain this result it is generally necessary to make one or two trial mixes and it is emphasized that the preparation of this surface should be given good supervision.



All dimensions in millimetres

FIG. 3 TYPICAL SECTION OF FOUNDATION FOR VERTICAL TANKS

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Sugar Industry Sectional Committee, FAD 02

Organization	*Representative(s)*
National Sugar Institute, Kanpur	Shri Narendra Mohan (***Chairman***)
Army Service Core (ASC), New Delhi	Lt Col B. B. Sahu
CONCERT, Chennai	Shri R. Santhanam Shri M. Somasundaram (*Alternate*)
Consumer Guidance Society of India, Mumbai	Shri Sitaram Dixit Dr M. S. Kamat (*Alternate*)
Food Corporation of India, New Delhi	Shri Deepak Kumar Panwar Shri Rakesh Kumar Ranjan (*Alternate*)
Food Safety Standards Authority of India, New Delhi	Ms Apoorva Srivastava (*Technical Officer*)
Global Cane Sugar Ltd, New Delhi	Dr G. S. C. Rao Mr Anil Srivastava (*Alternate*)
Indian Institute of Sugarcane Research, Lucknow	Dr A. D. Pathak Dr A. K. Sharma (*Alternate*)
Indian Institute of Toxicology Research, Lucknow	Dr Yogeshwer Shukla
Indian Sugar Mills Association, New Delhi	Shri G. K. Thakur Shri Deep Malik (*Alternate*)
Indian Sugar Exim Corporation, New Delhi	Shri Rajiv Aggarwal Mr Rajeev Kurup (*Alternate*)
MAARC Labs, Pune	Dr Vasudha Keskar
MANAS Industry, Maharashtra	Shri Jeevan Vasant Jadhav
Ministry of Consumer Affairs, Food & Public Distribution, New Delhi	Shri Suresh Chandra
National Co-operative Development Corporation, New Delhi	Shri K. P. Vaish Shri N. K. Sharda (*Alternate*)
National Federation of Co-operative Development Corporation, New Delhi	Shri Prakesh P. Naiknavare Shri S. Somasundaram (*Alternate*)
The Sugar Technologists Association of India, New Delhi	Shri Sanjay Awasthi Shri Anurag Goyal (*Alternate*)
Triveni Engineering & Industries Ltd, Muzaffarnagar, UP	Shri Rajesh Singh Shri P. K. Khadelwal (*Alternate*)
Tamil Nadu Sugar Corporation Ltd (TASCO), Chennai	Shri E. Muthuvelappan
Vasantdada Sugar Institute, Pune	Dr Rajeev Dani
Walchandnagar Industries	Shri D. R. Sardeshmukh Shri P. V. Kawade (*Alternate*)
In personal capacity	Prof S. K. Gupta
BIS Directorate General	Shrimati Suneeti Toteja, Scientist 'E' and Head (FAD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Rajpal
Scientist 'D' (FAD), BIS

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Amend No.	Date of Issue	Text Affected

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